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Effort-Reward Imbalance at Work and Risk of Long-Term Sickness Absence in the Danish Workforce

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Objective: To examine whether effort-reward imbalance (ERI) at work predicts onset of register-based long-term sickness absence (LTSA) in a representative sample of the Danish workforce. **Methods:** We measured effort, reward, ERI, and covariates with self-administered questionnaires in a sample of 4775 employees. LTSA during 12-months of follow-up was assessed with a national register. We calculated hazard ratios (HRs) with Cox proportional hazard models. **Results:** The HR of LTSA for a one-SD increase in ERI was 1.03 (95% confidence interval [CI], 0.93–1.15) in the most-adjusted model. For effort, the HR for a one-SD increase was 0.95 (95% CI, 0.85–1.06) and for reward the HR for a one-SD decrease was 1.14 (95% CI, 1.03–1.26). **Conclusions:** ERI was not associated with onset of LTSA. Low reward, however, predicted LTSA.

The Effort-Reward Imbalance (ERI) model is a theoretical model originating from medical sociology that explains how psychosocial working conditions can affect health and illness.[1,2] The model postulates that a lack of reciprocity between "costs" and "gains" (spending high efforts while receiving low rewards) produces emotional distress that affects both mental and physical health. Effort includes dealing with quantitative workload and time pressure, whereas rewards encompass monetary gratification, career opportunities, esteem, respect, and job security.

Prospective studies have demonstrated that ERI increases the risk of several disease outcomes,[3,4] including cardiovascular disease[5,6] and mental ill health.[7–10] Several cross-sectional studies[11–16] and three prospective studies[17–19] have shown that ERI also predicts the onset of long-term sickness absence (LTSA). In the prospective studies, ERI predicted LTSA among British civil servants,[17] Finnish public sector employees,[18] and Belgian teachers.[19] To the best of our knowledge, no prospective study has yet investigated whether ERI predicts LTSA in a representative sample of a national workforce.

The paucity of prospective studies about ERI and risk of LTSA is surprising because the ERI model might be well-suited for predicting LTSA. There are at least two pathways through which ERI could increase the risk of LTSA. First, ERI might increase risk of onset of ill health, such as cardiovascular disease[5,6] or depression,[7–10] which will increase risk of LTSA. Second, employees experiencing a high-cost/low-gain situation at work may be inclined to change this imbalance by reducing their effort, which could be achieved by sickness absence. In this case, sickness absence would not be a consequence of ill health but a coping strategy to deal with adverse psychosocial working conditions.[20]

In this article, we examine whether ERI predicts onset of LTSA in a representative sample of the Danish workforce. LTSA is assessed by a national register, allowing us to perform time-to-event analyses and avoid common method bias. We hypothesize that high ERI predicts increased risk of LTSA in the cohort and that the two components (high efforts and low reward) are also associated with an increased risk of LTSA.

METHODS

Study Design and Population

This study is based on survey data of ERI from the Danish Work Environment Cohort Study (DWECS) in 2000 and register data of LTSA from the Danish Register for Evaluation of Marginalisation (DREAM). After the participants filled in the DWECS survey, they were observed for the next 12 months in DREAM. Records were linked by the unique participants' personal identification number from the central population register. Detailed descriptions of the two data sets and their linkage in work environment studies on sickness absence are published elsewhere.[21–23]

DWECS is a longitudinal study on work and health in the Danish working population, initiated in 1990.[21] In 2000, a representative sample of 11,437 Danish residents was approached, of which 8583 (75%) responded to the survey. Among the respondents, 5016 were gainfully employed at the time of the survey. We have shown in a previous analysis that the sample of the gainfully employed respondents was representative for the Danish workforce with regard to sex and age.[21] There were indications that employees from the city of Copenhagen were somewhat less likely to participate in DWECS compared with employees from other Danish regions.[21] We excluded 147 participants with missing values on key variables. Furthermore, we excluded 94 participants with onset of LTSA during the first 2 weeks of follow-up. This was because several of these participants might have already been ill during the DWECS baseline survey and that their ill health could have affected their responses in the survey. The resulting final study sample consisted of 4775 employees. Mean age was 40 years (range, 18 to 69 years) and 48% were women. Table 1 gives a detailed description of the study sample.

Definition and Measurement of ERI

Because DWECS does not include the original ERI questionnaire, we assessed effort and reward with proxy measures. A detailed report on the construction of these proxy measures, the wording of each item, and the calculation of the scores for effort, reward, and the ERI ratio is published elsewhere.[24] In brief, we measured effort with four items (eg, not having time to complete all work tasks) and rewards with seven items. The seven

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The study has been notified to and registered by the Danish Data Protection Agency (Datatilsynet). According to Danish law, studies that include data from questionnaires and registers only do not need approval from the Danish National Committee on Biomedical Research Ethics (Den Centrale Videnskabsetiske Komité).

The authors declare that they have no conflict of interest.

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TABLE 1. Baseline Characteristics of the Whole Study Sample and of Participants With Onset of LTSA During Follow-Up

	All Participants ($N = 4775$)	LTSA Cases ($n = 375$)
ERI ratio, M (SD)	0.53 (0.18)	0.53 (0.19)
Age, y, M (SD)	40.43 (10.81)	40.49 (10.41)
Sex		
Men % (*n*)	51.7 (2470)	45.1 (169)
Women % (*n*)	48.3 (2305)	54.9 (206)
Cohabitation		
Yes % (*n*)	78.2 (3734)	79.7 (299)
No % (*n*)	21.8 (1041)	20.3 (76)
Children at home		
None % (*n*)	49.3 (2355)	48.0 (180)
Youngest <7 yrs % (*n*)	23.9 (1140)	23.2 (87)
Youngest ≥7 yrs % (*n*)	26.8 (1280)	28.8 (108)
Current smoking		
No % (*n*)	62.8 (3000)	49.3 (185)
Yes % (*n*)	37.2 (1775)	50.7 (190)
Alcohol consumption		
No/moderate % (*n*)	94.8 (4525)	92.8 (348)
Heavy % (*n*)	5.2 (250)	7.2 (27)
Leisure-time physical activity		
Sedentary % (*n*)	14.5 (690)	17.1 (64)
Light activity % (*n*)	42.7 (2038)	41.9 (157)
Moderate activity % (*n*)	32.2 (1536)	31.7 (119)
Strenuous activity % (*n*)	10.7 (511)	9.3 (35)
Body mass index		
Underweight % (*n*)	1.7 (82)	2.4 (9)
Normal % (*n*)	59.4 (2836)	54.4 (204)
Overweight % (*n*)	31.1 (1487)	33.6 (126)
Obese % (*n*)	7.8 (370)	9.6 (36)
Occupational grade		
I; White collar, high % (*n*)	16.3 (778)	6.1 (23)
II; White collar, medium % (*n*)	16.1 (770)	14.4 (54)
III; White collar, low % (*n*)	34.7 (1657)	34.7 (130)
IV; Blue collar, skilled % (*n*)	13.8 (657)	14.9 (56)
V; Blue collar, semi-/unskilled % (*n*)	19.1 (913)	29.9 (112)
Mental health M (SD)	87.15 (11.76)	85.87 (13.91)
Previous LTSA (12 months before baseline)		
No % (*n*)	93.9 (4485)	80.8 (303)
Yes % (*n*)	6.1 (290)	19.2 (72)

ERI, effort-reward imbalance; HR, hazard ratio; LTSA, long-term sickness absence.

reward items included all the three dimensions of the reward concept in accordance with Siegrist et al,[2] that is, two financial and status items (prospects for future; appropriateness of salary), three esteem items (recognition and appreciation by management; help and support from colleagues; help and support from supervisors), and two job security items (worried about becoming unemployed; worried about involuntarily transferred to another job). In accordance with the literature, we calculated an effort and reward scale by summing up the respective items and then constructed an "effort-reward imbalance ratio" by dividing the effort score by the reward score.[2]

Definition and Measurement of LTSA

We defined onset of LTSA as the first record of a sickness-absence period that lasted 3 weeks or more in DREAM. In Denmark, employers are obliged to finance sickness-absence benefits for the first 21 days of absence (before June 2008, it was the first 15 days).[25] When the absence period exceeds 21 days, the employer is eligible for sickness benefit compensation from the municipality and the compensation is recorded in DREAM. From this point on, the municipality also becomes responsible for managing and evaluating the sickness-absence process and for initiating actions that might help the sickness-absence beneficiary to return to work. For these reasons, we regarded 21 days as a meaningful cutoff point for defining LTSA in a Danish context.

DREAM contains weekly updated information on all social transfer payments in Denmark, including granted sickness-absence benefits since 1982.[22,23] Under specific circumstances, for example, if the sick-listed employee is registered with a chronic disease or if the

workplace has contracted an insurance policy, the municipality pays sickness-benefit compensation already from the first day of absence. Unfortunately, the available data did not allow us to differentiate between beneficiaries who received the usual sickness-absence benefits from those who received benefits under those specific circumstances. Hence, although the vast majority of cases entered the analyses after a sickness-absence period of at least 3 weeks, a small minority of cases might have been on sickness absence for a shorter time period.

Measurement of Covariates

We recorded age, sex, cohabitation, age of children living at home, current smoking, alcohol consumption, leisure-time physical activity, body mass index, occupational grade, mental health, and LTSA within the last 12 months before baseline. Age and sex were retrieved from the central population register, LTSA within the last 12 months was retrieved from the DREAM register, and the other variables were retrieved from self-report in DWECS. Occupational grade was assessed on the basis of information about job title, occupational position, and education. Mental health was measured with the MHI-5 scale of the 36-item short-form health survey,[26] which ranges from 0 to 100 points, with higher scores indicating better mental health. More detailed descriptions of the covariates are published elsewhere.[21,24,27–29] An overview of the baseline distribution of the covariates in the whole study sample and in participants who became cases of LTSA during follow-up is shown in Table 1.

In addition to these covariates, we also measured physical workload with an index combining five items on (1) sitting at work (reversed), (2) kneeling and squatting, (3) pushing and pulling, (4) carrying and lifting load, and (5) weight of the load that is carried or lifted. This index has been recommended in an earlier analysis by Burr et al.[29] Because physical workload is also considered as an element of effort at work in the original ERI questionnaire,[2] we did not adjust for this covariate in the main analyses but analyzed its potential confounding effect separately.

Statistical Analysis

We calculated crude and adjusted hazard ratios (HRs) and 95% confidence intervals (CIs) for the prospective association of a one-SD increase of the ERIratio at baseline with time to onset of LTSA during the 12-month follow-up. Participants were observed until onset of LTSA, censoring due to emigration or death, or end of follow-up, whichever came first. We incrementally adjusted the HRs: in model 1, we adjusted the HRs for sociodemographic variables (age, sex, cohabitation, children at home), and health behaviors (smoking, alcohol consumption, physical activity, and body mass index); model 2 was further adjusted for occupational grade; model 3 was further adjusted for mental health and previous LTSA.

In supplementary analyses, we used ERI as a categorical variable (ERI ratio divided into quartiles) and stratified analyses by sex and occupational grade. Finally, we examined the separate contribution of effort and reward to LTSA by calculating HR and 95% CI of LTSA for the effort scale, the reward scale, and each single effort and reward item.

All analyses were conducted with the Stata/SE 12.1 statistical software (StataCorp LP, College Station, TX). Possible violations of the proportional hazard assumption were examined by Schoenfeld residuals.

RESULTS

During the 12-month follow-up, 375 participants (7.9%) had an episode of LTSA, 42 (0.9%) were censored due to emigration or death, and 4358 (91.3%) completed the follow-up period without event or censoring. Mean time to onset of LTSA was 26.4 weeks (SD, 15.6) with a median time of 27 weeks.

ERI and Onset of LTSA

Table 2 shows the crude and multivariate analyses on the prospective association between ERI at baseline and onset of LTSA. ERI did not predict LTSA in any statistical model. In the fully adjusted model, the HR of LTSA for a one-SD increase on the ERI ratio was 1.03 (95% CI, 0.93–1.15). When we used ERI as a categorical variable (quartiles of the ERI ratio) instead of the continuous score, results were similar (data not shown). Adding the physical workload index to the analyses affected the HR only marginally (data not shown).

Among the covariates, female sex, current smoking, lower occupational grade, and previous LTSA predicted LTSA in the fully adjusted model. Occupational grade showed a strong gradual association with risk of LTSA, that is, the lower the occupational grade, the higher the HR of LTSA. When we analyzed the association between ERI and LTSA stratified by sex, we found similar results as in the main analysis. In the fully adjusted model, the HR of LTSA for a one-SD increase on the ERI ratio was 1.01 (95% CI, 0.88–1.16) among women and 1.08 (95% CI, 0.92–1.27) among men (data not shown in table). Stratification by occupational grade also did not yield any statistically significant result (data not shown).

Effort, Reward, and Onset of LTSA

Table 3 shows the HR of LTSA with regard to the effort scale, the reward scale, the three reward subdimensions, and the single effort and reward items adjusted for covariates.

The effort scale and the four single effort items were not related to risk of LTSA. A one-SD increase on the reward scale, however, predicted onset of LTSA with an HR of 1.14 (95% CI, 1.03–1.26). Of the three reward subdimensions, a decrease in the dimension "financial and status reward" (HR, 1.12; 95% CI, 1.04–1.20) and in its item "appropriateness of salary" (HR, 1.20; 95% CI, 1.05–1.38) were statistically significant predictors of LTSA. Adding the physical workload index to the analyses affected the HR only marginally and did not affect the statistical significance of any association (data not shown).

Postestimation tests showed that the proportional hazard assumption was fulfilled in all analyses.

DISCUSSION

We hypothesized that ERI at work predicts onset of LTSA in this representative sample of the Danish workforce. This hypothesis was rejected. There was no association between ERI and LTSA, neither in the crude nor in the adjusted analysis. When we analyzed effort and reward separately, we noted that effort was not related to LTSA. Low reward at work, however, predicted risk of LTSA, as hypothesized. In particular, the reward dimension of low "financial and status reward" contributed to risk of LTSA.

Comparison With Earlier Studies

The results of this study are incongruent with earlier analyses on ERI and health outcomes from the same cohort, which showed that ERI predicted a decline in self-rated health[24] and the onset of severe depressive symptoms[10] after a 5-year follow-up. Both poor self-rated health[30] and severe depressive symptoms[31,32] are known to predict LTSA and it is therefore surprising that ERI predicted these two health outcomes but not LTSA in this cohort.

Moreover, our results are in disagreement with three earlier prospective studies that showed an association between ERI and LTSA. In the British Whitehall II Study, ERI assessed with six proxy measures for effort and 10 proxy measures for reward predicted LTSA—defined as absence spells of 8 days or more—in male and female civil servants after adjustment for age, occupational grade, physical illness, and long-standing illness.[17] In the Finnish 10-Town Study, ERI assessed with one proxy measure for effort and three proxy measures for reward predicted LTSA—defined as absence

TABLE 2. ERI at Baseline and Onset of LTSA During 12-Month Follow-Up

	Crude		Model 1		Model 2		Model 3	
	HR	(95% CI)	HR	(95% CI)	HR	(95% CI)	HR	(95% CI)
ERI, one-SD increase	0.98	(0.89–1.09)	1.00	(0.91–1.11)	1.06	(0.96–1.17)	1.03	(0.93–1.15)
Age, one-SD increase			0.98	(0.87–1.09)	1.01	(0.90–1.13)	1.00	(0.89–1.12)
Female gender			1.48	(1.19–1.83)***	1.48	(1.18–1.85)**	1.36	(1.09–1.71)*
Living alone			0.85	(0.65–1.12)	0.82	(0.63–1.08)	0.80	(0.61–1.04)
Children at home								
Youngest child <7 y			1.01	(0.76–1.34)	1.05	(0.79–1.39)	1.03	(0.78–1.37)
Youngest child ≥7 y			1.04	(0.82–1.33)	1.04	(0.82–1.33)	1.06	(0.83–1.36)
Current smoking			1.84	(1.49–2.26)***	1.65	(1.34–2.04)***	1.58	(1.28–1.95)***
Heavy alcohol consumption			1.32	(0.89–1.98)	1.39	(0.93–2.08)	1.28	(0.86–1.92)
Physical activity								
Light activity			0.85	(0.64–1.14)	0.87	(0.65–1.16)	0.88	(0.65–1.18)
Moderate activity			0.92	(0.68–1.25)	0.94	(0.69–1.28)	0.96	(0.71–1.31)
Strenuous activity			0.86	(0.57–1.31)	0.90	(0.59–1.37)	0.92	(0.60–1.40)
Body mass index								
Underweight			1.33	(0.68–2.60)	1.41	(0.72–2.76)	1.37	(0.70–2.68)
Overweight			1.32	(1.05–1.66)*	1.25	(1.00–1.58)	1.23	(0.98–1.55)
Obese			1.56	(1.09–2.23)*	1.39	(0.96–1.99)	1.32	(0.92–1.89)
Occupational grade								
II; White collar, medium					2.17	(1.33–3.56)**	2.06	(1.26–3.38)**
III; White collar, low					2.37	(1.51–3.73)***	2.25	(1.43–3.53)***
IV; Blue collar, skilled					2.87	(1.75–4.69)***	2.56	(1.57–4.20)***
V; Blue collar, semi-/unskilled					3.84	(2.43–6.07)***	3.29	(2.07–5.21)***
Mental health, one-SD increase							0.92	(0.84–1.01)
Previous LTSA							3.26	(2.51–4.23)***

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.
CI, confidence interval; ERI, effort-reward imbalance; HR, hazard ratio; LTSA, long-term sickness absence.

TABLE 3. Association of Effort, Reward, the Three Reward Subdimensions, and the Single Effort and Reward Items at Baseline With Onset of LTSA During 12-Month Follow-Up

	HR	(95% CI)
Effort-scale (4 items; range of scale, 4–20 points)	0.95	(0.85–1.06)
Effort item #1: Work piles up (range of item, 1–5 points)	0.98	(0.90–1.07)
Effort item #2: No time to complete work task (range of item, 1–5 points)	0.92	(0.83–1.01)
Effort item #3: Have to work overtime (range of item, 1–5 points)	0.96	(0.87–1.05)
Effort item #4: Have to work fast (range of item, 1–5 points)	1.03	(0.94–1.13)
Reward scale (7 items; range of scale, 7–27 points)	1.14	(1.03–1.26)**
Reward subdimension: Financial and status reward (2 items; range of scale, 2–8 points)	1.12	(1.04–1.20)**
Reward item #1: Future job prospects (range of item, 1–5 points)	1.09	(0.99–1.20)
Reward item #2: Appropriateness of salary (range of item, 1–3 points)	1.20	(1.05–1.38)**
Reward subdimension: Esteem reward (3 items; range of scale, 3–15 points)	1.03	(0.98–1.08)
Reward item #3: Recognized and appreciated by management (range of item, 1–5 points)	1.09	(0.97–1.22)
Reward item #4: Support from colleagues (range of item, 1–5 points)	1.04	(0.94–1.15)
Reward item #5: Support from supervisors (range of item, 1–5 points)	1.04	(0.96–1.13)
Reward subdimension: Job security reward (2 items; range of scale, 2–4 points)	1.13	(0.96–1.33)
Reward item #6: Worried becoming unemployed (range of item, 1–2 points)	1.14	(0.89–1.47)
Reward item #7: Worried being involuntarily transferred (range of item, 1–2 points)	1.21	(0.92–1.58)

HR for a one-point increase in effort or a one-point decrease in reward. HR is adjusted for age, sex, cohabitation, children at home (none, youngest <7 y, youngest ≥7 y), smoking, alcohol consumption, leisure-time physical activity (sedentary, light, moderate, strenuous), body mass index, occupational grade, mental health, and previous LTSA.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.
CI, confidence interval; HR, hazard ratio; LTSA, long-term sickness absence.

spells of 4 days or more—in male and female public sector employees after adjustment for age, level of occupation, types of work contract and work schedule, marital status and dependent children, smoking, alcohol consumption, sedentary lifestyle, and overweight.[18]

In a Belgian study, ERI assessed with six effort and 11 reward items from the original ERI questionnaire[2] predicted LTSA—defined as absence spells of 4 days or more—in school teachers after adjustment for sex and family situation.[19]

Possible explanations for the disagreement of our results with the previous findings are differences in the assessment of ERI, the assessment of LTSA, the study population, and contextual factors. Our assessment of ERI was more comprehensive than the one used in the 10-Town Study,because we covered all the three dimensions of the reward concept. On the contrary, the teacher study measured not only occurrence of exposure, as we did, but also appraisal of the exposure by the participants. With regard to LTSA, we defined this as an absence spell of 21 days or more; whereas, in the previous studies, the criterion for LTSA was already fulfilled after spells of 4 days or more (10-Town Study and teacher study) and 8 days or more (Whitehall II Study), respectively. Furthermore, the study populations of all the three previous studies were public sector employees, whereas our study population included employees from both the public and the private sector. Finally, our results might be explained by contextual factors, such as differences in the sickness-absence legislations and practices in the different countries.[25]

In line with our results, Lund et al[33] have previously reported that high rewards protected against very-long-term sickness absence of 8 weeks or more in the DWECS cohort. Nevertheless, the reward scale used by Lund et al[33] was not constructed according to the conceptualization in the ERI model. It included only three items, two of the items we also used in the present study (acknowledgement and appreciation by management and job prospects) and one additional item on acknowledgement and appreciation by society.

The Role of Occupational Grade

Occupational grade was a strong predictor of LTSA. Compared with the reference group of high-grade white-collar workers, all other groups had a statistically significantly increased risk of LTSA. There was a clear indication of a dose-response association between decreasing occupational grade and increasing risk of LTSA. This is in line with previous research on another Danish workforce sample that also reported a strong occupational gradient in risk of LTSA.[34]

Earlier, we reported that the association between ERI and risk of severe depressive symptoms was stronger among employees at lower occupational grade.[10] We therefore considered occupational grade as an effect modifier and conducted additional analyses stratified by occupational grade. Nevertheless, these stratified analyses did not yield any substantially different results and did not indicate effect modification by occupational grade.

Strengths and Weaknesses of the Study

The strengths of the study are the prospective design and the use of a representative cohort of a national workforce. Consequently, the results are not restricted to specific industries or occupational groups but can be generalized to the Danish workforce.

Another strength of the study is the use of a national register on sickness-absence payments to assess LTSA. This allowed us to follow-up with all participants and to perform time-to-event analyses. DREAM has been extensively used for sickness-absence research in Denmark and the validity of the register for research use is well documented.[22,23]

The ERI model is a well-established theory for defining adverse psychosocial working conditions. In our study, we assessed ERI by proxy measures because the original ERI questionnaire was not available in the study. We have previously shown that these proxy measures predicted health outcomes,[10,24,27] and therefore considered the ERI measure as valid operationalization of adverse psychosocial work environment exposures. Nevertheless, we acknowledge that the items and the response scales are not identical to those in the original ERI questionnaire. In particular, the response scales differed substantially. In the original ERI questionnaire, participants are asked to assess the occurrence or nonoccurrence of the exposure and to further assess the extent to which they felt distressed by the exposure.[2]

In our study, we only asked the participants to rate the frequency of the exposure and did not assess their distress level.[24] Hence, in the original ERI questionnaire, both occurrence of the exposure and psychological reaction to the exposure are measured, whereas our measurement was restricted to the occurrence of the exposure.

As in other studies on ERI, we measured ERI and its components by self-report. Self-reported psychosocial exposure measures have many advantages, but they have the major disadvantage that they might be biased by negative effect or other personal characteristics.[35] As the ERI model defines both effort and reward as individual appraisals of these constructs, developing non–self-reported measures might not be feasible. Thus, we tried to account for bias by adjusting the analyses for mental health at baseline.

The DREAM database does not include information about diagnosis. Therefore, we could only analyze LTSA in general and not cause-specific LTSA. This prevented us from analyzing whether ERI might have different effects on LTSA due to different causes, for example, due to cardiovascular disease, mental disorders, or musculoskeletal disorders.

CONCLUSIONS

We conclude that self-reported ERI did not predict LTSA in a representative sample of the Danish workforce. Nevertheless, self-reported low reward at work, and particularly low financial and status reward, predicted onset of LTSA, also after adjustment for numerous covariates including occupational grade and previous LTSA.

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